House of Commons

Science and Technology Committee

The science budget

First Report of Session 2015–16

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Science and Technology Committee

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Committee reports are published on the Committee's website at www.parliament.uk/science and by The Stationery Office by Order of the House.

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Summary

The United Kingdom is a science superpower. In terms of both quality and productivity, our research base punches above its weight', setting a worldwide benchmark for excellence.

Government spending on the science base has been protected since 2010, with a flat-cash-ring-fenced budget for annual 'resource' spending distributed by the research councils, the Higher Education Funding Council and others. Annual 'capital' budgets have varied. The Government has already announced that capital spending within the science budget will be protected — in real terms — up to the end of 2021. The Government's Spending Review on 25 November will determine the science — and innovation — budget allocations for the rest of this Parliament.

The UK has fallen behind its competitors in terms of total R&D investment and this will put UK competitiveness, productivity and high-value jobs at risk if it is not reversed. The Government should produce a long term 'roadmap' for increasing public and private sector science R&D investment in the UK to 3% of GDP — the EU target. This would send an important signal about the long term stability and sustainability of our science and innovation ecosystem, supercharging private sector R&D investment from industry, charities and overseas investors alike.

A more robust system is needed to integrate capital and resource funding allocations. The Government should urgently review existing capital allocations to ensure sufficient resource is in place to fully 'sweat our assets'. Sufficient resource funding will only materialise, however, with an upward trajectory in the resource budget.

The Spending Review is being conducted under present accounting protocols, dealing with capital and resource budgets for science separately. 'ESA-10' accounting rules will in future count resource expenditure on R&D as capital, reflecting the fact that all expenditure on science research is an investment — an asset — in future economic capacity. The Government in the Spending Review should make it clear that this rules revision will not be used as a means to change the underlying funding settlement.

The 'dual support' system has produced a world class and highly efficient system for scientific research. Any significant changes to this system, including the balance of funding between research councils and university funding councils, would require a clear justification, which has yet to emerge. The Government should make clear its continued commitment to the dual support system, and the previous Government's 2010 iteration of the Haldane Principle in the forthcoming Spending Review. A significant element of research funding should continue to be channelled though both the research councils and the higher education funding authorities. Clear justification will also be needed for any significant change in funding allocations between the research councils, and we caution against a radical reorganisation which could potentially harm the research programme.

Any expansion of the innovation catapult network should not come at the expense of other innovation priorities. The Government should focus on consolidating the existing catapults, to ensure that all will have the necessary operating resource and business strategies to operate at peak capacity. To show a clear commitment to innovation more generally, the Government should ring-fence Innovate UK's budget.

The Government should also retain the current system of innovation grants — rather than loans — as a key policy tool, alongside R&D tax credits, for de-risking innovation investment.

The Spending Review will have a profound impact on our science base and our future prosperity. We have to get it right. We have a duty to take care that our spending and structural decisions in this area do more than merely maintain the status quo. If we get our spending priorities, our policies, regulatory frameworks or our immigration policy wrong, we will be on the wrong side of history. The Government must ensure that the UK remains a scientific superpower.

1 Introduction

The case for science and innovation

1. The United Kingdom is a science superpower. In terms of both quality and productivity, our research base "punches above its weight",[1] setting a worldwide benchmark for excellence. Numerous witnesses in our inquiry provided evidence of this, including Innovate UK:

> The strength of our globally respected research base is an unparalleled strategic asset for the UK and we must continue to invest in it. With 0.9% of the world's population, and 3.2% of its R&D spend, we produce 15.9% of its most important research output. The UK is home to 4 of the top 6 Universities in the world. The output of this engine of new knowledge discovery is a constant source of potential commercial advantage.[2]

2. The UK has much to boast about. UK research is cited in 10.9% of all patent applications worldwide, we rank 2nd globally for the quality of our scientific research institutions, we come 2nd in the Global Innovation Index (which compares 143 countries on 81 indicators) and are 4th for university-industry collaboration.[3]

3. This is an excellence driven science and innovation ecosystem that has produced 80 Nobel Prize winners but also some extraordinary improvements in our way of life, as the Campaign for Science and Engineering illustrated:

- Global research efforts have led to cancer treatments and interventions delivering health gains equivalent to £124 billion for UK patients between 1991 and 2010 through prevention, early identification, and improved survival.
- One million more properties were protected in the floods of 2013–14 compared to similar floods in 2007 as a result of government-funded research. This saved £2.6 billion of lost working days in London alone and £2 billion in fewer and less expensive insurance pay- outs.
- R&D has improved aircraft fuel efficiency by 30% since 1990, saving over 400 million tonnes of CO_2 per year, and is expected to improve efficiency by a further 38% between 2010 and 2050.[4]

4. It is important to remember that these achievements rest on a long established principle, recognised by successive governments, that excellent research, translated into innovation, not only brings huge societal benefits — widespread electrification, better healthcare, mass production of food, better transport links — but is also a precondition for productivity growth. Indeed the Government's Productivity Plan opens its chapter on Science with the following:

1 Universities UK (TSB0045)
2 Innovate UK (TSB0048), para 7
3 Royal Society, *Building a Stronger Future* (Feb 2015)
4 Campaign for Science and Engineering (TSB0051), para 7

> The creation and application of new ideas is critical for long-run productivity growth. There is clear and robust evidence of a link between R&D spending and national productivity.[5]

In our increasingly knowledge-based economy, the pursuit of excellence in research and innovation breeds competitiveness and high-value jobs growth, and UK researchers play a critical role in addressing major national and global challenges.

5. It is notable that even in difficult financial times this is an argument the public 'get'. A BIS/Ipsos Mori Public Attitudes to Science survey in 2014 showed that 76% thought that scientific research made a direct contribution to economic growth, 79% agreed that even if it brought no immediate benefits scientific research that advances knowledge should be funded by the Government, and that 65% disagreed that such funding should be cut because it might be better spent elsewhere.[6]

6. If the economic and social case for investing in science has been won with both government and the public, our science and innovation ecosystem should be fully invested and operating at peak capacity. The Chancellor has certainly been a consistent champion for science, protecting the science ring-fence in cash terms throughout the last Parliament and reversing damaging cuts to capital spending at a time of significant cuts to other areas of government spending. Nevertheless, the instability in capital spending and the real terms loss in spending power has had its consequences, as we discuss below.

7. Furthermore, while our excellence in research is world leading and unquestioned, numerous witnesses made the case that our success in exploiting this research, though improving, remains suboptimal. The Centre for Process Innovation Limited, a founder partner of the High Value Manufacturing Catapult, working at the intersection of university-industry collaboration, concluded that although the catapult network and Technology Transfer Offices are beginning to make a difference: "most UK universities [still] have limited ability to convert research findings into commercial products and services".[7] The Institution of Engineering and Technology was emphatic about the need for improvement in commercialisation support, currently funded through the innovation budget:

> The UK has consistently failed to exploit fully the results of its research outputs. There are many reasons for this including short-termism, risk aversion and an academic bias against industry and commerce. This is against a backdrop of rapid technical advances and industrial expansion in Asia and elsewhere and thus solving the issue is becoming increasingly urgent.[8]

8. The Government will make a decision on science and innovation funding as part of its Spending Review, to be published on 25 November. Simultaneously, the findings of the Dowling Report into strengthening university-industry collaborations, the Nurse Review into the structure of the Research Councils and the McKinsey Review into the structure of the Department for Business, Innovation and Skills are also being considered and will inevitably shape decisions about spending allocations. As these decisions are taken

5 HM Treasury, *Fixing the foundations: Creating a more prosperous nation* (July 2015), p 37
6 Ipsos Mori, *Public attitudes to science 2014* (March 2014); University of Oxford (TSB0068), para 19
7 Centre for Process Innovation (TSB0020), para 3.2.1
8 Institution of Engineering and Technology (TSB0019)

we must remember that we hold a position of great responsibility in the global scientific community.

9. We face a century filled with complex societal challenges — ageing, chronic and complex illnesses, climate change, and sustainably feeding nine billion people. Our scientists and innovators across academia and industry will be at the forefront of the discoveries that will not only underpin the productivity of our economy but will ensure the sustainability of our way of life.

10. We have a duty to take care that our spending and structural decisions in this area do more than merely maintain the status quo. If we get our spending priorities, our policies, regulatory frameworks or our immigration policy wrong, we will be on the wrong side of history.

Our inquiry

11. We decided to undertake an inquiry into the Science Budget, and to report ahead of the Spending Review. We began by taking oral evidence in July from Jo Johnson MP, the Minister for Universities and Science. We invited written submissions on the following issues:

- The extent to which the current ring-fence arrangements, and the separate arrangements for determining 'resource' and 'capital' allocations, have produced coherent UK science and research investment;
- The extent to which science and research expenditure in Government departments (outside the science budget) complements or competes with the science budget;
- The need for and rationale for any adjustment to the trajectory of future Government expenditure on science and research, and what would be gained from an increase (or lost from a reduction) compared with current expenditure levels;
- Whether the current distributions of the budget between particular types of expenditure and between different organisations is appropriate for future requirements, and achieves an appropriate balance between pure and applied research;
- What level of Government expenditure on science and research is needed:
    - to significantly drive the overall level of such expenditure in the economy, through synergies between government and private sector investment (including overseas investment); and
    - to optimally balance its benefits against the opportunity cost of government expenditure foregone on other public services.
- Whether the Government's expenditures on aspects of science and research are consistent with other government policies, including the Industrial Strategies and the Eight Great Technologies and fiscal incentive policies for research investment; and
- The extent to which any increase or reduction in Government expenditure on science and research will have an impact on the UK's relative position among competitor states.

12. We received 78 written submissions from a wide variety of sources: from academies to businesses, from charities to campaigners, from learned societies to individuals. We completed our oral evidence sessions, including a second meeting with the Minister, in October. We are grateful to all those who contributed evidence.

2 What we spend on science and innovation now

The science budget

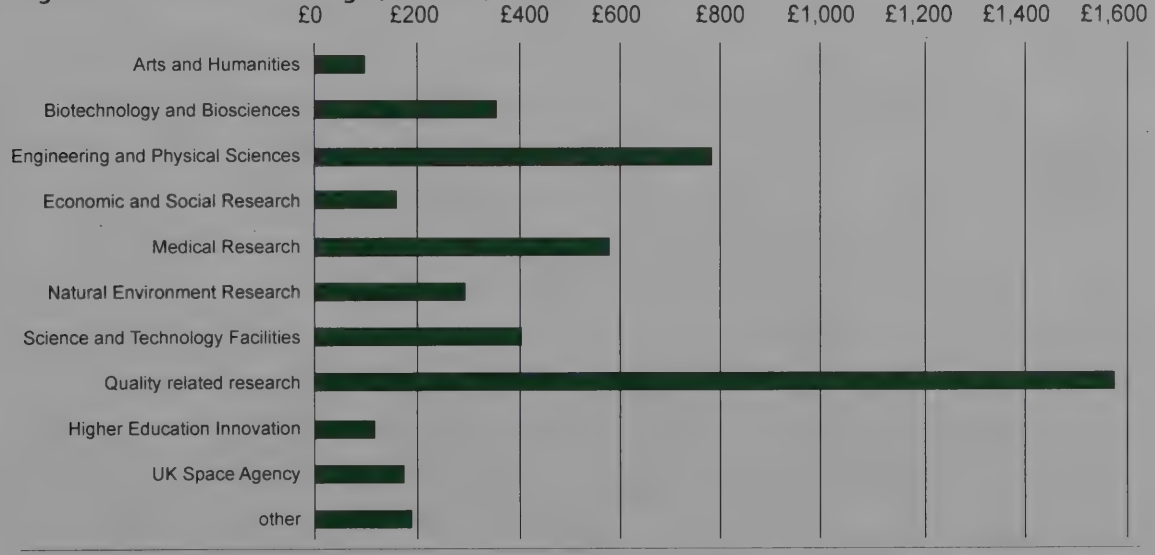
13. The science budget is managed by the Department for Business, Innovation and Skills (BIS). In May 2014, the Government published the 2015–16 resource and capital budget allocations for the science budget, with the largest beneficiaries being the research councils, the Higher Education Funding Council for England and the UK Space Agency. National academies like the Royal Society also benefit from this budget. In total, £4.7 billion has been allocated for resource spending and £1.1 billion for capital.[9]

Resource

14. The 'resource' element of the budget has been broadly static in cash terms since 2010–11. It remained unchanged in 2015–16 despite a post-General Election round of budget reductions for BIS itself. While protected from spending reductions that affected many departments in 2010, the effect of inflation means it will buy around 6% less in 2015–16 than it did in 2010–11. The Campaign for Science and Engineering calculated that "the annual funding shortfalls resulting from the 2010 flat-cash settlement for the resource science budget have accumulated to a £1 billion loss to the UK research base over the lifetime of the last [2010–2015] Parliament."[10]

15. Most allocations within the total science budget have remained consistent over this period. Figure 1 shows the distribution of funding to the research councils and others in 2015–16. The Higher Education Funding Council for England distributes the majority of its funds for research on the basis of research quality, and takes into account the volume and relative cost of research in different areas. This is called 'quality-related research funding'.

Figure 1: Current science budget, 2015–16, £ million



9 The resource budget is slightly higher than the £4.6 billion 'policy ring-fence' agreed between BIS and HM Treasury This is because of additional funding for science in 2015–16 allocated at subsequent fiscal events. BIS thus makes a distinction between the science budget and the science ring-fence. (BIS (TSB0075), paras 41–43)

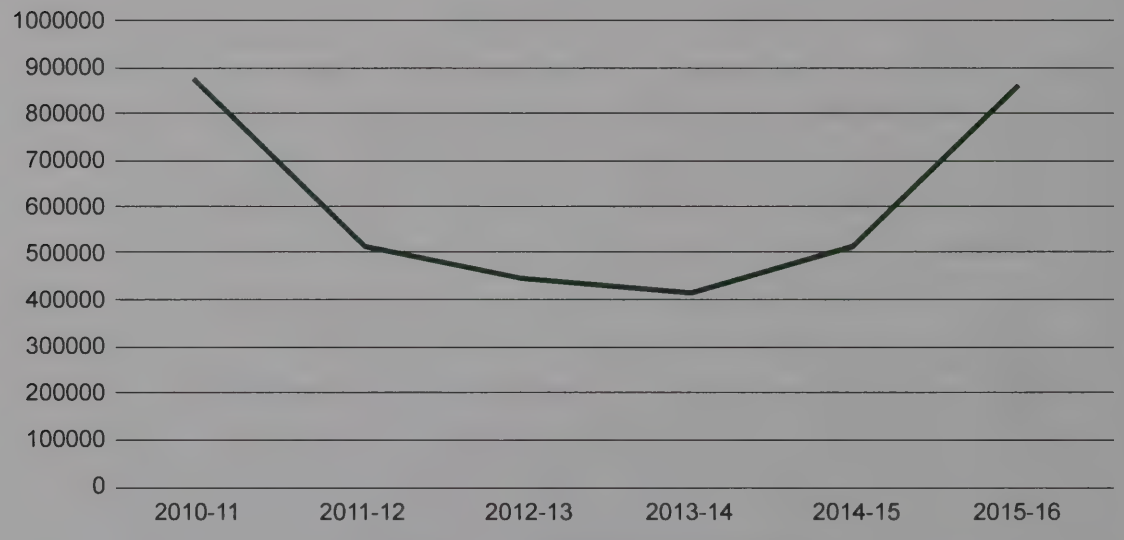
10 Campaign for Science and Engineering (TSB0051), para 9

Capital

16. The corresponding capital science budget is smaller (Figure 2) and has fluctuated far more over the last few years, falling from £0.87 billion in 2010–11 to £0.42 billion in 2013–14, before rising again to £0.86 billion in 2015–16 (Figure 3). As is evident from Figure 3, the scale of the cut in the capital budget during the last Parliament created uncertainty for researchers and investors alike.

Figure 2: Capital science budget, 2015–16, £ million

Figure 3: Capital science budget, 2010–11 to 2015–16, £'000



Source: Science and technology budget allocations for financial year 2015–16, BIS, 2014

17. The Government's manifesto commitment, repeated since the General Election, to inflation-protect the 2015–16 science capital budget of £1.1 billion up to 2021 is very welcome. It stands as a clear endorsement of the principle that long term stability in science funding is crucial to efforts not only to recruit and retain the best and brightest researchers but also essential for attracting large-scale inward investment. The Government stated that it would:

> invest new capital on a record scale — £6.9 billion in the UK's research infrastructure up to 2021 — which will mean new equipment, new laboratories

> and new research institutes. This long-term commitment includes £2.9 billion for a Grand Challenges Fund, which will allow us to invest in major research facilities of national significance, such as the new Alan Turing Institute, and projects such as the Polar Research Ship and Square Kilometre Array.[11]

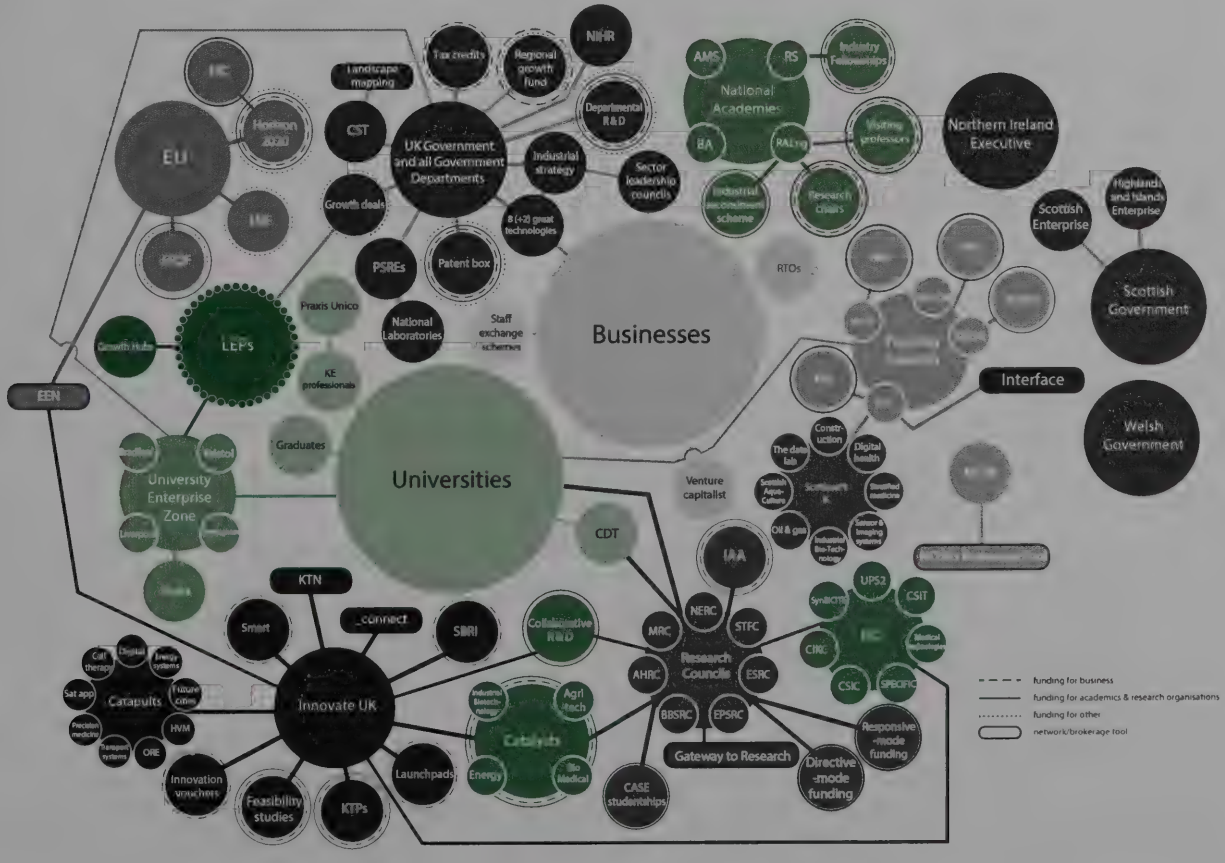
This reflects a trend in recent years of linking science investment funding commitments to specific projects or programmes.

18. The consequence of the Summer Budget's target to run a surplus by 2019–20 is that all 'unprotected' departments, including BIS, must find savings of 25–40%. It should be noted, however, that in the overall scheme of Government spending, the science budget is modest, accounting for less than 1%. This means that a 10% increase, for example, would represent less than 0.1% of overall Government expenditure.

Other science and innovation funding

19. There are many sources of public funding and support for the science and innovation ecosystem in addition to the 'science budget', presenting a complex support structure for researchers and innovators (Figure 4). These include innovation spending, R&D tax incentives and research in Government departments. As Figure 4 demonstrates, improving commercialisation is not simply about increasing funding. The complexity of the science and innovation landscape can act as a barrier to researchers and innovators seeking access to the support which is already available.

Figure 4: Academia/industry links (from Dowling report)

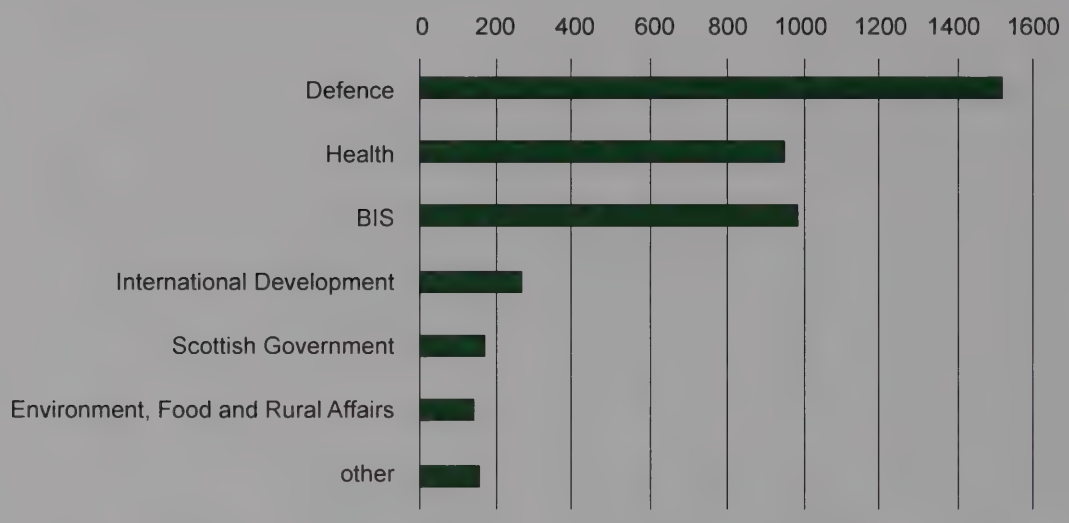


11 BIS (TSB0075), para 6

Departmental research and development

20. Beyond the BIS science budget, several Government departments spend significant further sums on research and development, amounting in 2013 to some £4.17 billion, of which £1.52 billion is spent on defence research. Information on government research and development spending is summarised in Figure 5. R&D is distinguished from related activities by requiring an appreciable element of novelty and the resolution of scientific and/or technological uncertainty. This definition of R&D therefore excludes things like education, training, bibliographic and referencing work, routine technological development (e.g. the deployment of software systems that are already well understood) and the management of existing knowledge and data.

Figure 5: 2013 R&D spending, £ million



21. Government departments' spending on R&D, unlike the science budget, is not ring-fenced. Departments can choose to increase or reduce it and reallocate resources as they see fit, depending on their priorities. Like other departments, BIS also spends on research and development in addition to the science budget.

Innovation

22. Government expenditure on innovation also lies outside the science budget, and consequently has not had ring-fence protection. It is also difficult to measure. It comprises funding for Innovate UK, but it can also encompass science-related research work in Government departments. Some 64% of UK R&D carried out between 1985 and 2013 was performed by business, receiving funding from a variety of sources, including Government.

3 A roadmap for research and development

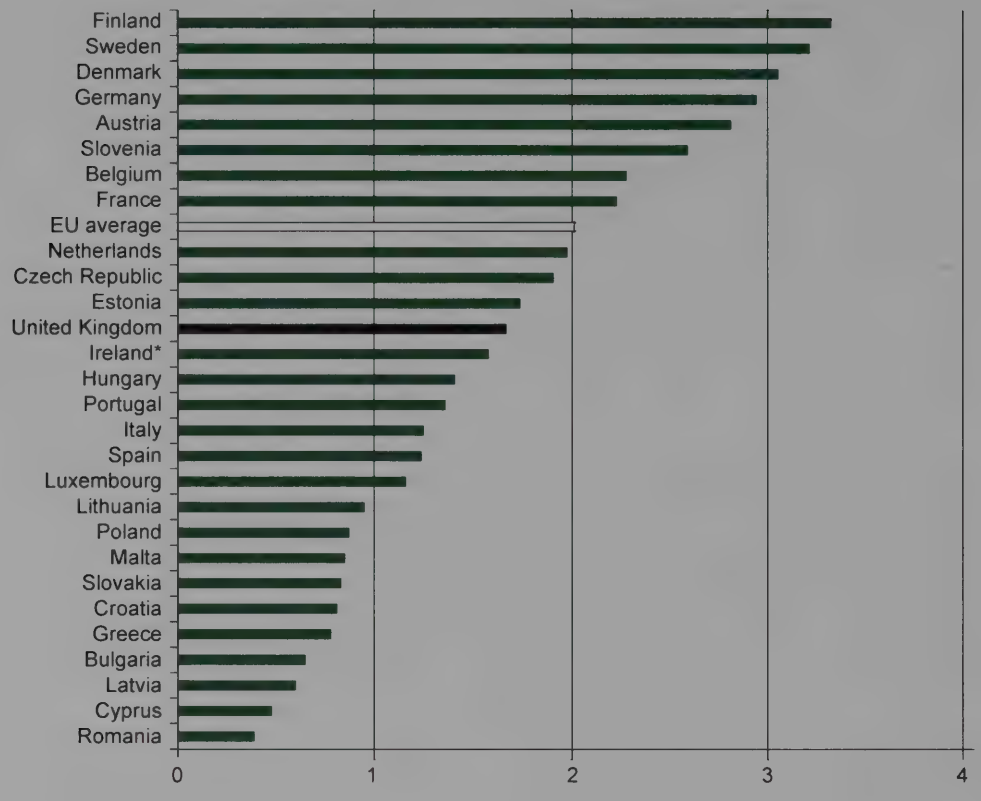
23. Even though "on many measures [the UK Science base] is the most efficient in the world",[12] producing excellent research in a highly competitive system, witnesses expressed near unanimous concern that at least since 2004 the UK's level of public and private R&D investment has been internationally low and falling. Imperial College London were clear that this would have consequences:

> the UK is falling behind its international competitors in terms of its investment in R&D. For example, in 2005 the UK invested 1.70% of GDP in R&D, increasing slightly to 1.82% in 2009 before declining back to 1.72% in 2012. In contrast, China increased its investment in R&D from 1.32% of GDP in 2005 to 1.98% in 2012, and the US increased its investment in R&D from 2.51% of GDP in 2005 to 2.79% in 2012. Within Europe, France increased its investment in R&D from 2.11% in 2005 to 2.26% in 2012, and Germany increased its investment in R&D from 2.51% in 2005 to 2.92% in 2012. Without increased investment in R&D, therefore, the UK risks losing its position at the forefront of research globally, particularly given the rapid rate of advance in scientific research and the intense levels of international competition.[13]

24. In 2013 gross domestic expenditure on R&D (GERD) in the UK was £28.9 billion. Between 1985 and 2013 GERD grew by 52% in real terms, but fell as a proportion of GDP from 2.01% to 1.67%.[14] The UK government sector (research councils, higher education funding councils and Government departments) funded around 29% (£8.4 billion) of R&D performed in the UK in 2013[15] — less than 0.5% of GDP. OECD countries on average spend 2.4% of GDP on science, with in general about a third of this coming from public funds. The UK is placed 12th in the EU for total gross domestic expenditure on R&D (Figure 6).

12 Universities UK (TSB0045)
13 Imperial College London (TSB0013), para 1
14 House of Commons Library, *Briefing Paper SN04223: Research and Development in the UK* (July 2015)
15 Ibid.

Figure 6: Gross expenditure on R&D, 2013



25. The Campaign for Science and Engineering warned that although there are some statistical problems with GERD data, which is leading to underestimated UK GERD values and incomplete international league tables, the UK's low international position for R&D investment could not be explained away as an anomaly and that our competitors are forging ahead, with some, like Israel and Korea, investing as much as 4.2%.[16]

Investment time lag

26. Along with many witnesses, the University of Oxford highlighted an investment time lag: "the effects of the recent downward trajectory in funding will not be seen for some time: Studies suggest that the average time from initial research to biomedical and health benefits is 15–20 years."[17] Universities UK similarly told us that:

> Research has shown that the time-lag between investment in science and the full realisation of benefits can be in the order of decades. As such, the consequences of failing to invest in a sustainable and effective research base now may not be immediately apparent; conversely, the positive outputs that we see now are the result of sound investments in the past, and efforts to create a sustainable research funding environment over the last decade.[18]

27. The Minister went some way to acknowledging the time lag between research and its impacts when, in July, he told us:

16 Campaign for Science and Engineering (TSB0051), para 66
17 University of Oxford (TSB0068), para 9
18 Universities UK (TSB0045)

> Of course, there is potential for these outputs to be lagging indicators, and we would want to be very wary of any slippage there. To the extent that the indicators continue to perform well we can be satisfied that we are investing at an appropriate level, but we would want to be very sensitive to the lagging factor. If that starts to emerge as a risk, we will be very attentive to it.[19]

28. The risk of such an approach, however, could be to hold back action until discrete areas of science actually manifest signs of deterioration. This same 'lagging factor' means that any remedy to such deterioration would not bear fruit for some years. This is clearly not a sensible way to manage a national strategic asset like our science and innovation ecosystem. Professor Alison Davenport, Chair of the advisory Science Board of the Science and Technology Facilities Council (STFC) told us that:

> The fact that we are currently still productive and "punch above our weight" despite five years of flat cash is at least in part due to the fact that we are living off investments from years/decades earlier. For example, both the discovery of the Higgs boson and the Rosetta mission are based on investments made in the 1990s.[20]

> STFC science and technology is in a precarious position. We are living on past investments, and are currently on a knife-edge: flat cash for another five years will lead to an accelerated decline with serious and irreversible damage to particle physics, astrophysics and nuclear physics with loss of highly skilled staff, a trajectory for UK X-ray, neutron and laser facilities leading to closure of one facility and major loss of operations in the others, and serious damage to innovation and industrial engagement.[21]

Professor Brian Cox was just as alarmed:

> If there is another flat cash settlement, realistically it is dire. That is not my opinion; it seems to be the unanimous opinion of the research councils. Certainly in my area, for the STFC, it is an absolute disaster. I would be extremely pessimistic if that happened.[22]

29. The Royal Society of Chemistry believed that even a real-terms freeze on science spending would leave the UK in danger of falling behind our competitors, many of whom are continuing to invest heavily in research and development. They wanted resource funding to be ring-fenced and protected against inflation, but also for the Government to "commit to a long-term ambition to increase science spending as economic growth returns".[23] Similarly, the Royal Society of Edinburgh wanted "to see the Government commit to at least a trajectory for the resource budget to be rising over the term of this Parliament and starting to close the investment gap with some of our key competitors".[24]

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19 Q9
20 STFC's Science Board (TSB0042), para 12
21 Ibid, para 31
22 Q212
23 Royal Society of Chemistry (TSB0035), para 8
24 Royal Society of Edinburgh (TSB0061), para 17

The productivity case for R&D investment

30. In 2002, when the European Council adopted a target of spending 3% of GDP on public and private sector R&D, its economic analysis showed that the policy would "have a significant impact on long-term economic growth and employment in Europe, to the order of 0.5% of supplementary output and 400,000 jobs per year after 2010".[25]

31. The Government's own research shows that 51% of productivity growth between 2000 and 2008 was due to innovation[26] and that firms that consistently invest in R&D were 13% more productive than those that do not.[27] The knowledge economy already accounts for one third of all jobs, with STEM jobs commanding salaries 20% above the average.

32. There is also clear evidence that publicly funded R&D creates a strong 'multiplier effect' and 'crowds-in' private sector, charitable and inward investment, stimulating around 30% more self-investment from industry.[28] For every £1 spent by the Government on R&D, private sector R&D productivity rises by 20p per year in perpetuity.[29] As Universities UK told us: "this would imply ... a total discounted value (at a 5% discount rate) of a 300% return on the initial investment. If the higher bound of the estimate is used, a discounted value of a 900% return on investment would be expected."[30]

Absorptive capacity

33. It is important to note the role of public sector R&D grants in promoting absorptive capacity in industry and why this matters for developing a competitive science and innovation ecosystem. Absorptive capacity is the "ability of a firm to identify, understand and exploit knowledge developed elsewhere in the innovation system".[31] Hughes and Martin argued in 2012 that:

> The impact of publicly funded research will be substantially affected by the capacity of other actors in the economic and innovation system to access, understand and use the research outputs produced with public sector support. This depends to a considerable extent on the R&D that the private sector itself carries out. R&D activity in the private sector has two purposes or 'faces'; it creates new knowledge in itself but it also enhances the firm's 'absorptive capacity.'[32]

34. It is no good having a fantastically productive research base if industry does not have enough people with the right set of skills to understand and develop those ideas. This is a crucial part of the innovation pipeline driven by R&D investment.

25 European Commission, *Investing in research: An action plan for Europe* (2003)
26 BIS, *Our plan for growth: science and innovation – Evidence paper* (December 2014), p5
27 Speech by Vince Cable,BIS Secretary of State, *Innovation and the UK knowledge economy* (July 2014)
28 Jonathan Haskel, Alan Hughes and Elif Bascavusoglu-Moreau, *The Economic Significance of the UK Science Base* (March 2014)
29 BIS, *Estimating the effect of UK direct public support for innovation* (Nov 2014)
30 Universities UK (TSB0045)
31 Hughes, A. Martin, B., *Enhancing Impact: The Value of Public Sector R&D* (2012)
32 Ibid

Setting a roadmap for UK research and development investment

35. In 2014, the Business Innovation and Skills Committee recommended a target of 3% of GDP by 2020 for total R&D spending,[33] while a report commissioned by the Government that year suggested 2.9% of GDP.[34] Innovate UK cited two studies, the more conservative of which calculated that long run productivity is maximised with 2.3 – 2.6% of GDP spent on R&D.[35] Crucially, they noted that, unlike our international peers, the UK does not have a long-term plan for increasing investment in R&D. The Royal Society favoured an increase in Government R&D expenditure to at least match the OECD average of 0.67% of GDP by 2020. Naomi Weir of the Campaign for Science and Engineering called for R&D across Government to be increased by the end of this Parliament "above inflation, particularly with low inflation at the moment and the predictions for growth".[36]

36. The Government, however, does not seem to be convinced. Jo Johnson assured us that the productivity arguments for science investment were not lost on the Government:

> We are making a very strong case for the public and private returns on R&D expenditure. They are unarguable. There are private returns of 20% in perpetuity on every pound of public investment. We all agree on the evidence base around the crowding-in effect that public investment has on private investment ... For every pound of public investment, between £1.13 and £1.59 of private investment is crowded in. These are important factors, and the Treasury takes them into account.[37]

He nevertheless saw an EU target of spending 3% of GDP as "a nice round number, more than anything else".[38] He counselled against focusing on such targets and argued that research outputs were a more reasonable consideration than spending 'inputs'.[39] In other fields, where outcomes are more difficult to quantify, the Government is happy to commit to spending targets — legislating to set minimum spending on overseas development aid at the UN target (0.7% of national gross value added), and committing in the Summer Budget to meet NATO's defence spending target of 2% of GDP.

37. **The UK has fallen behind its competitors in terms of total R&D investment and this will put UK competitiveness, productivity and high-value jobs at risk if it is not reversed. *We recommend that the Government produce a long term 'roadmap' for increasing public and private R&D investment in the UK to 3% of GDP. This would not only provide focus and accountability for public sector R&D investment but also send an important signal about the long term stability and sustainability of our science and innovation ecosystem, supercharging private sector R&D investment from UK industry, charities and overseas investors alike.***

33 Business, Innovation and Skills Committee, Seventh Report of Session 2014–15, *Business-University Collaboration*, HC 249.
34 BIS, *Insights from international benchmarking of the UK science and innovation system* (Jan 2014)
35 Innovate UK (TSB0048), para 39
36 Q150
37 Q230
38 Q232
39 Q9

4 Capital, resource and the ring-fence

38. While the Government has made a commitment to protect the £1.1bn annual capital science budget in real terms up to 2021, concerns have been raised on two points. Firstly, witnesses wanted assurances that this new budget commitment signalled not only much welcomed long term stability but also a greater degree of transparency and predictability for capital spending decisions. Secondly, witnesses almost unanimously called for better strategic linking between capital and resource allocations.

39. The previous Government's Science and Innovation Strategy (2014), which Jo Johnson MP described as "current " in July,[40] stated:

> Of course, capital investment alone is not sufficient to ensure our research infrastructure is able to continue to deliver world class outputs. We recognise that our science base requires adequate resource funding, and will give full consideration to these requirements when we take a decision at the Spending Review next year.[41]

The failure to have adequate resource spending to match capital spending commitments, however, has been a recurrent theme throughout our inquiry. The STFC's Science Board told us that:

> under-exploitation of science infrastructure (failure to 'sweat the assets') as a result of inadequate resource for running costs is very wasteful and damaging to UK science. Of the UK's X-ray, neutron and laser facilities, only Diamond (X-rays) is operating close to the optimum number of operations days.[42]

The Royal Society of Chemistry gave the same example:

> The £400m ISIS neutron source at Harwell currently operates well below maximum capacity and will run for only approximately 120 days this year, instead of an optimal 180 days, reportedly due to in insufficient funding for operational costs.[43]

40. In addition to high profile investment initiatives, capital funding is needed for core, enabling infrastructure. The University of Oxford told us that this remains in "critically short supply: whilst it lacks the 'wow' factor, investment in the routine, workhorse equipment that all institutions need to support excellent research and train the next generation of highly-skilled academic and industrial researchers is vital." They added that:

> The requirement from research councils for institutions to contribute up to 50% towards the cost of individual items of equipment (introduced in response to the cut in their capital budgets) and the low likelihood of securing industry co-funding for core infrastructure, presents further difficulties for the largest universities.[44]

40 Q2
41 HM Treasury and BIS, *Our plan for growth: science and innovation*, Cm 8980 (December 2014)
42 STFC's Science Board (TSB0042), para 7
43 Royal Society of Chemistry (TSB0035), para 14
44 University of Oxford (TSB0068), para 6

41. Resource and capital spending are to a great extent interdependent. Capital investment not accompanied by a supporting resource budget is likely to diminish the assets' productive use. The phrase "batteries not included", attributed to Lord Krebs,[45] has been regularly cited as a major issue for capital investments.[46] Innovate UK were particularly concerned about this point:

> An effective innovation system links together 'capital' and 'resources' in an integrated package that supports and drives value creation...The 'capital' can be invested in a one to two year period to create the capability, but the 'resource' elements need to be in place for up to five years after the 'capital' to ensure the centre becomes established and sustainable.[47]

42. **While we welcome the Science and Innovation Strategy's commitment to delivering sufficient resource funding, and the Minister's assurance that this would be delivered, in reality, given existing capital commitments, this will only materialise with an upward trajectory in the resource budget. In addition, we are deeply concerned to hear of under-utilised facilities and a crisis in funding for mid-size equipment and core infrastructure. *We recommend that the Government conduct an urgent review of all existing capital allocations to ensure sufficient resource is in place to fully 'sweat our assets' and further recommend development of a more robust system of integrating future capital and resource allocations so that full value is realised for every capital investment.***

Accounting systems

43. Complicating the question of optimally balancing capital and resource budgets is the prospect of the distinction between them disappearing, at least in the public-sector R&D sphere. Professor Graeme Reid flagged up this issue in June 2015, noting that European Standard of Accounting 10 ('ESA-10') would require both resource and capital spending to be treated as capital investment in future.[48] The logic behind this was a recognition by the Eurostat accounts-setters that even resource expenditure is designed "to increase the stock of knowledge"[49] — an asset rather than consumption. Professor Reid told us in September that he expected the UK to introduce that protocol at some point after the Spending Review.[50] Subsequently, Jo Johnson informed us that:

> For the Spending Review in November, my understanding is that they will observe the existing conventions of treating science resource and science capital as distinct pots of money. Thereafter, ESA-10 will start to apply, as it does in the [Office for National Statistics] national accounts, and there will be a new definition of resource spending as capital.[51]

44. The future treatment of capital and resource spending together could, if handled well, offer opportunities. Innovate UK believed that "a consistent approach that integrates

45 Q194
46 Royal Society of Biology (TSB0084), para 1.2
47 Innovate UK (TSB0048), paras 13–14
48 Westminster Higher Education Forum, *Priorities for science and innovation policy: opportunities, structures and investment* (June 2015)
49 ONS, *Transition to ESA 10: Impact on public sector finances* (Feb 2014)
50 Q158
51 Q264

'capital' and 'resource' will build confidence and demonstrate that the UK is committed to the long-term creation of value."[52] The National Physical Laboratory envisaged that:

> More efficient use of overall science spending can be achieved by removing the separation between capital and programme budgets. Capital spend profiles at institutions with large scale facilities such as NPL would benefit from the ability to flex spending plans year on year, eliminating the practice of wasteful year-end spending from fixed, expiring budgets. Instead, providing funding at institution level would allow organisations to decide how best to apportion investment between new capabilities and resource, resulting in greater value for money.[53]

45. Universities UK, on the other hand, cautioned against treating these two kinds of funding as equivalent, given their distinct objectives.[54]

46. ***The Spending Review is being conducted under present protocols, dealing with capital and resource budgets for science separately. Any subsequent change to the way in which science and innovation spending are classified must be transparent, allowing like-for-like comparisons with year-on-year expenditures set in the Spending Review. The Government should make it clear in the Spending Review that ESA-10 will not be used as a means to change the underlying funding settlement.***

Ring-fence

47. Many of our witnesses highlighted the benefits of the ring-fencing mechanism, irrespective of the sums involved, in providing certainty and confidence to allow long-term planning. Not only is this important for the direct beneficiaries of science funding, it matters to businesses attracted by our strong science base. Dr Paul Beasley of Siemens told us:

> Certainly for business, there is a need for some sort of stability. The introduction of the impact agenda and the industrial strategy five years ago was quite important for us to convince headquarters that there was strategic importance in any investments they made, and we could grow that. The possibility now that some of that would be reversed and that there is potential for a cut would call into question future investment in this particular area.[55]

Innovate UK pointed to the long history of the ring-fence as evidence of its effectiveness as a policy mechanism:

> ... the ring-fence has remained in place as responsibility for the science and research has moved from one government department to another over the last 25 years (during which time, government responsibility for science and research has been in the Department for Education and Science, the Cabinet Office, the Department of Trade and Industry, the Department of Innovation, Universities & Skills and the Department of Business, Innovation & Skills). Ring-fencing has provided confidence and stability for long-term science at

52 Innovate UK (TSB0048), para 19
53 National Physical Laboratory (TSB0030), para 4.1
54 Universities UK (TSB0045)
55 Q321

> times of economic turbulence and organisational change. It has created an environment in which businesses and charities from around the world often choose to invest in long-term strategic relationships with the UK science base in preference to other countries.[56]

48. If the case for a ring-fence of the science budget seems clear cut, however, the debate about what should fall within it is not. During the last Parliament, although the ring-fence was protected, a number of different budgets moved in and out of the ring-fence. In addition, major strands of funding like the innovation budget and departmental R&D, accounting for billions of pounds of Government investment in our science and innovation ecosystem, sit not only outside the ring-fence but spread throughout different Government departments and budgets.

Innovation

49. Government expenditure on innovation has not had ring-fence protection. It is difficult to measure because it includes not only Innovate UK, but also some science-related research work in Government departments (paragraph 20).

50. Innovate UK's budget doubled during the last Parliament. They highlighted, however, that "over recent years the BIS science budget has far outweighed the innovation budget". The 2014–15 budget for the research councils was £2.7bn, for HEFCE £3.9bn and for Innovate UK £0.4bn. Innovate UK emphasised that businesses invest "significantly more in translation/development and commercialisation than on early stage research", and they believed that their own budget was "disproportionately low".[57]

51. Dr Ruth McKernon of Innovate UK and Martyn Sené of the National Physical Laboratory argued that innovation spending should be protected in similar ways to the science budget. Martyn Sené believed that "the infrastructures, such as the catapults and NPL, and the interventions, such as those made by Innovate UK, need long-term sustainable policy and funding behind them; otherwise, you have an F1 engine and no transmission."[58]

52. Innovate UK suggested that the rationale for ring-fencing some budgets and not others needed to be revisited. They considered that funding for innovation through support of business and for infrastructure, such as through catapult centres, should be afforded ring-fence protection. Translation of early-stage research, through the stages of the 'Technology Readiness Scale', to deliver commercial products and businesses, they pointed out, is equally a long-term endeavour.[59] Our predecessor Committee examined this 'valley of death' in 2013.[60]

53. In July, the Minister told us:

> As a Government, we are committed to making sure that we exploit fully the commercial potential of the research and science base in which we are

56 Innovate UK (TSB0048), para 10
57 Innovate UK (TSB0048)
58 Q87
59 Innovate UK (TSB0048), para
60 Science and Technology Committee, Eighth Report of Session 2012–13, Bridging the valley of death: improving the commercialisation of research, HC 348

> investing so heavily. The innovation budget plays a really important part in that. As you may recall, in our manifesto we commit to important elements of the innovation programme, including expanding our successful catapult network.[61]

54. Numerous witnesses questioned how further catapults could be funded and if current catapult funding would be affected. Referring to two new catapults (precision medicine and medical technologies), Jo Johnson MP assured us that these "do not impact on the funding streams in the business cases for the catapults we already have."[62] However, in written evidence, Innovate UK described existing challenges facing some catapults:

> Two of [Centre for Process Innovation's] major centres are facing challenges within the current UK funding environment, where adequate 'capital' has been invested but the 'resource' support is inadequate for the UK to maximise its value creation. These projects are the National Biologics Manufacturing Centre and the National Formulation Centre. In both of these cases, the required 'capital' has been delivered but the 'resources' to run the centres have been made available for only one year, and are not adequate for the operating costs that are particularly pronounced in the early years of operation, as the facilities ramp up and industrial engagement progresses from zero to fully utilised. This obviously causes a number of problems to CPI, but it also has a major impact on the private sector partner networks that plan to use the centres. These partners include multinational companies, such as GSK or Proctor & Gamble, SMEs and university spin-outs. As a result, multi-nationals will redirect spending to other countries and the UK capability will be lost or never created — thus losing competitiveness. However, the negative impact is greater on the smaller companies as, in many cases, they do not have the financial strength to develop their processes and business models without the collaborative partnership that comes from working in the UK innovation system with the catapult centres.[63]

55. **The catapult network is a key success of the last Government's commitment to strengthen our capacity to exploit research by building better research-industry partnerships. It is understandable, therefore, that the current Government should wish to build on this success by expanding the catapult network.** ***While we commend the motivation, we feel the first priority should be to consolidate and establish the existing catapults — in particular ensuring that all catapults have the necessary operating resource and business strategies in order to operate at peak capacity.***

56. ***Catapults are only one strand of innovation support, however, and commitments to expanding the catapult network should not come at the expense of other innovation priorities. The Government has made successive, clear commitments to innovation more generally and should deliver on these by ring-fencing Innovate UK's budget.***

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61 Q5
62 Q7
63 Innovate UK (TSB0048), paras 16–17

Departmental research and development

57. The Scienceogram campaign was among the contributors to our inquiry that highlighted the role of spending across Government:

> Just under half of UK public R&D funding is disbursed directly by Government departments. As well as contributing to the general advancement of knowledge across a range of socially and economically important areas, this research should underpin evidence-based policymaking across government.[64]

The Royal Society of Edinburgh believed that overall science policy and the links with the science and research budgets of departments such as Health, DEFRA and the Ministry of Defence were not clear. They told us:

> It is not completely transparent as to what proportion is spent on straightforward procurement of equipment and how much is supporting research. In addition, as the departmental budgets overall have been declining in recent years, it is likely that the individual spend on research within each department has declined. This makes it even more important that the Government starts to increase the science budget year on year.[65]

The Academy of Social Sciences described research by Government departments as a "Bermuda Triangle", with the expenditure discretionary and usually a very small proportion of departmental budgets.[66]

58. We will soon begin an 'evidence check' exercise to test the degree to which policies are well-founded in scientific research. The exercise will over time, we hope, help departments to seek to fully utilise their departmental research resources and budgets. ***We recommend that major government policy announcements and new legislation should be routinely accompanied by a formal statement of the relevant evidence base, without depending on a prompt from our forthcoming evidence checks.***

59. The Royal Society of Edinburgh put a good case for more information, including an annual report, on Government science spending across all departments.[67] It would enable the science and business communities, and Parliament, to better monitor and track the level of government support for innovation as well as science.

60. **We are dismayed by the steep decline in research and development in some departments. This is driven by understandable budgetary pressures but also by lack of transparency surrounding these budgets.** ***We recommend that the Government produces an annual report to Parliament setting out, and explaining, public spending on science and innovation, including the rationale for the relative support given to scientific research and to innovation.***

64 Scienceogram UK (TSB0028), para 18
65 Royal Society of Edinburgh (TSB0061), para 26
66 Academy of Social Sciences (TSB0036)
67 Royal Society of Edinburgh (TSB0061), para 10

5 Distribution

Dual support

61. The distribution of the science budget raises two issues: the proportion of funding that goes to HEFCE and how the remainder should be apportioned among individual research councils. In the lead up to the Spending Review, it has been reported that BIS's work to identify financial savings, as a 'non-protected' department, might impinge on the way the science budget is allocated. McKinsey were commissioned by BIS to review operating costs across the Department and its 'partner bodies'. Such partners include the Higher Education Funding Council for England and the research councils — the two organisations which allocate the bulk of the science budget to researchers under the so-called 'dual support' system. We received some assurances from the Secretary of State during our inquiry that McKinsey's work had not addressed the science budget allocations. Concerns remained, however, that if the operating costs of the funding bodies are dramatically reduced, the efficacy of their funding allocation systems and the research they fund may be indirectly impacted.

62. The Higher Education Funding Council for England, which distributes the majority of its funds for research on the basis of research quality, takes into account the volume and relative cost of research in different areas ('quality-related research funding'). David Sweeney of HEFCE pointed out that "over 90% of our highly-cited, world-leading publications have university authorship, and we have universities in all parts of the country with diverse missions tackling global and local problems ... It is not just research that is one of our jewels in this country; our universities are."[68] He attributed much of the success of the UK's science base to the 'dual support' system.[69] Universities UK believed that the system of dual support was "fundamental to the autonomy of higher education institutions", in accordance with the Haldane Principle[70] (an iteration of which was published by the previous Government in 2010).[71] Universities lie at the heart of our success as a scientific nation, performing three-quarters of publicly funded R&D — a significantly higher proportion than in comparator countries.[72] When it comes to making funding decisions for science, the central importance of the UK university sector must continue to remain uppermost in ministerial minds.

63. The Institution of Engineering and Technology suggested, however, that the balance of HEFCE science block grant and research council funding should gradually be shifted more in favour of the latter. They considered that "HEFCE block grants should be limited to fewer universities and higher-impact research, rather than being spread thinly over a number of institutions."[73]

64. **The 'dual support' system has produced a world class and highly efficient system for scientific research.** ***Any significant changes to this system, including the balance of funding between research councils and university funding councils, would require a clear justification, which has yet to emerge. The Government should make clear its***

68 Q107
69 Q108
70 Universities UK (TSB0045)
71 HC Deb 20 December 2010, col 138WS
72 Universities UK (TSB0045)
73 Institution of Engineering and Technology (TSB0019), para 12

continued commitment to the dual support system and the previous Government's 2010 iteration of the Haldane Principle in the forthcoming Spending Review. A significant element of research funding should continue to be channelled though both the research councils and the higher education funding authorities.

Research councils

65. The President of the Royal Society, Sir Paul Nurse, is undertaking a review of the research councils, the results of which will be available for consideration in the Spending Review. He indicated to us that he saw scope for critically examining the way funding is allocated between the research councils and how their work is coordinated:

> It is interesting to note that the essential spending between the seven research councils remains rather stable over quite a few years. You have to wonder what that means, but it suggests that history may have quite a big impact on the future. That is certainly how some would interpret it. Personally, I think it might indicate that we need greater focus on overall strategic thinking and that maybe we do not have in our present structures the proper forum for those sorts of discussions to take place. It is not the easiest issue to deal with, because we need long-term stability but we also need agility.[74]

66. Evidence from Universities UK showed that while allocations between research councils had remained static over the last decade, there had been a shift in the balance of research council investment between basic (or fundamental) research and applied research, from a ratio of 67%:32% to 62%:36%, between 2002 and 2013.[75] Professor Rick Rylance of Research Councils UK acknowledged the role of history in determining funding allocations among research councils, but was worried that "if you start shifting too suddenly or too drastically, you will rob Peter to pay Paul and you run the risk of causing more damage than any possible good you can do. That may sound Panglossian, but it is a serious anxiety about perturbing the system."[76]

67. In July, Jo Johnson MP told us that:

> It has always been the case that Governments have set strategic priorities and made allocations between disciplines—for example, in terms of how much money research councils individually receive—that reflect bigger societal considerations, and that will continue to be the case.[77]

68. **Given the stable nature of funding allocations between the various research councils and the drive for greater strategic oversight in science funding, it is in order to consider if the research councils are working as an optimal system. However, the shift towards applied research over the last decade and the efficient, competitive and innovative output of the science they fund, imply that research councils are continuing to reflect changing research priorities and driving excellence in our science base.**

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74 Q65

75 Office for National Statistics, *Government expenditure on Science, Engineering and Technology*, 2013 (July 2015). The balance comprises 'experimental development' expenditure by research councils.

76 Q132

77 Q27

69. **While most witnesses accept there is scope for better interdisciplinary working and strategic oversight between research councils, clear justification will be needed for any significant change in funding allocations, beyond simply seeking further administrative efficiency savings or structural adjustments. Sir Paul Nurse's review will guide this process, and the Government will no doubt weigh its conclusions carefully.** ***But we caution against a radical reorganisation of the research councils which could potentially harm the research programme.***

6 Research and industry

Private investment

70. Businesses spend more than government on research and development. In 2013, business enterprise was responsible for £18.4 billion (64%) of UK gross domestic expenditure on R&D. Charities are also a significant source of funding for science. Cancer Research UK were among a large number of contributors to our inquiry who pointed out that, by investing in science, the Government leverages investment from businesses and charities. For example, in 2013, medical research charities funded £1.3 billion of health research, a third of all publicly funded medical research.[78] Many of our witnesses were acutely aware of the need to leverage as much funding as possible from the private sector. Dr Ruth McKernon of Innovate UK told us:

> I think it would help us, at a time when there is money in the private markets, to look at where there are opportunities to leverage additional private money. We already do matched funding, but is there a way we could get yet further funding from investment sources to help us grow those businesses and scale them? That is not an area we have focused on so far. We do really well with the funding we have. Both Innovate UK and the research councils are very efficient, but we are innovative; that is what we do, and we should not stop trying to make the money go as far as possible.[79]

71. The excellence of the United Kingdom's science base materially affects the level of inward investment by businesses, both in research and development and more generally.[80] There is a wide body of evidence that, in the context of the UK's research sector, increases in public sector investment leverage increased private sector investment rather than crowd it out.[81] Universities UK emphasised the importance of stable public expenditure: "A long-term commitment by government to maintain or increase support for research leverages substantial private research and development investment as it gives the private and charitable sector confidence to invest over a longer time horizon than they otherwise might."[82] The Royal Society of Chemistry believed that cutting public expenditure in research would be likely to trigger similar, additive, cuts from private investment.[83]

Mapping the science and innovation landscape

72. Among the key issues raised by Dame Ann Dowling in her recent review of business-university collaborations are a need to reduce the complexity of current support systems and to provide clearer advice to businesses: "The over-arching recommendation" of her review was that

> Government should seek to reduce complexity wherever possible and, where simplification is not possible, every effort should be made to ensure that the interface to businesses and academics seeking support for collaborative R&D

78 Cancer Research UK (TSB0005), para 12
79 Q86
80 Innovate UK (TSB0048), para 42
81 Universities UK (TSB0045)
82 ibid
83 Royal Society of Chemistry (TSB0035)

> is as simple as possible, even if internally the system of schemes is complex: a process that has been referred to as 'hiding the wiring'.[84]

73. Efforts to identify the different players and opportunities in the innovation space would also make it simpler for entrepreneurs to find what funding opportunities exist that are most suited to their needs. Dr Ruth McKernon told us that much of Innovate UK's work involved "asking how we can make it simpler for the person who wants to start a business and wants to know where to go to get funding, help and support to grow their company."[85] The "wiring" could be hidden without short circuiting the system. Innovate UK could have an important role as a guide to the opportunities available.[86] Martyn Sené told us that the NPL, other national laboratories and the catapults were important assets "sitting in the space between academia and businesses", and that "there need to be mechanisms and ways of getting our heads round where the capability is and how we can best use it."[87]

74. **We are disappointed that the Government has yet to respond to the Dowling Report given its important insights into gaps in our innovation landscape.** ***We recommend that the Government presents its response in the Spending Review.***

Financing and fiscal incentives

75. Tax incentives — reliefs which reduce tax and effectively leave more funds available for spending — have become an increasingly significant policy instrument to boost the R&D activities of businesses. With claims for 2012–13 totalling £1.4bn, R&D tax credits are now the largest source of Government support for business investment in R&D.[88] A recent study found that between £1.50 and £2.30 of additional R&D expenditure is stimulated by £1 of tax foregone.[89] The Royal Society of Chemistry observed that support for innovation and innovative companies is an essential component of a healthy research ecosystem.[90]

76. Recent reports suggest that the Government is considering converting at least some innovation grants to industry into interest-bearing loans. Virginia Acha from the Association of the British Pharmaceutical Industry has been reported as stating that:

> This would have potentially devastating consequences for the whole life-sciences sector, particularly the small to medium-sized biopharma enterprises.
>
> It takes on average 12 years and £1bn to develop a new medicine and, without support in the early stages to support SMEs in de-risking the process in a notoriously uncertain sector, innovation across life sciences would be seriously affected.[91]

Other sectors have echoed these concerns, stating that debt is not a viable financial option for funding early-stage, high-risk start-ups because it would raise their risk profile,

84 *The Dowling Review of Business-University Research Collaborations* (July 2015)
85 Q99
86 Q104
87 Q98
88 BIS (TSB0075), para 25
89 National Physical Laboratory (TSB0030), para 5.1
90 Royal Society of Chemistry (TSB0035), para 26
91 Financial Times: *Plans to swap grants for loans will hit R&D, warns UK business*, Peggy Hollinger and Jim Pickard (25 October 2015)

putting off potential investors. The strong multiplying effect of public R&D investment in crowding-in investment, and stimulating innovation, productivity and high value jobs, is based on its power to de-risk and bridge the 'valley of death'. 'Re-risking' innovation funding by converting it into loans will reduce those benefits. In the meantime, competitor nations are dramatically increasing their direct R&D support to industry. The Institution of Engineering and Technology told us:

> Competitive position in certain commercial markets has been achieved by large US companies often through 100% funded government research and development. This is most striking in aerospace where a number of technologies and sometimes whole engines in civil aerospace sector were derived from defence funded research.[92]

77. **Innovation loans may have a role to play as a new, additional, funding mechanism for later-stage ventures, but their success will depend greatly on the terms of any loans system introduced.** ***We recommend that the Government retains the current system of innovation grants as a key policy tool, alongside R&D tax credits, for de-risking innovation investment.***

78. If innovation funding was changed to loans, it would undermine the progress that the Government has made with tax incentives. Bernard Ross of Sky Medical Technology Limited described the "phenomenal environment with [the Enterprise Investment Scheme], R&D tax credits, grants and various other things that really are phenomenally supportive of innovation."[93] James Bromley of SwiftKey also talked approvingly of the Enterprise Investment Scheme, as well as the Seed Enterprise Investment Scheme: "I think the SEIS and EIS schemes have been absolutely brilliant for tech businesses, but there is one major issue: they have a lifetime cap" under EU state-aid rules. He concluded that "To commend what is being done with EIS and SEIS is correct, but there are some dark clouds looming for a number of companies who are reaching their lifetime limits."[94]

79. A further example of an incentive for businesses to engage in research is the R&D tax credit scheme. According to the Minister, this is one of the most generous schemes in the OECD.[95] James Bromley of SwiftKey echoed this but suggested improvements: "Typically, you may not get your R&D tax credit for 15 months after you first start incurring the cost, at best." He suggested moving to a quarterly payment model, like that for VAT.[96]

80. **Tax incentives have become a significant and welcome support for businesses seeking funding to innovate by applying research, but there remains scope for further assistance. Given the often thin operating margins of risky innovative start-ups, the delay in waiting for R&D tax credits is not ideal.** ***We recommend that the Treasury critically examine in the Spending Review the potential for extending the scope and availability of tax incentives and investment vehicles for innovation businesses. It should also examine alternative models for R&D tax credit payment, including the scope for a quarterly schedule.***

92 Institution of Engineering and Technology (TSB0019)
93 Q254
94 Q266
95 Q229
96 Q256

Conclusions and recommendations

A roadmap for research and development

1. The UK has fallen behind its competitors in terms of total R&D investment and this will put UK competitiveness, productivity and high-value jobs at risk if it is not reversed. *We recommend that the Government produce a long term 'roadmap' for increasing public and private R&D investment in the UK to 3% of GDP. This would not only provide focus and accountability for public sector R&D investment but also send an important signal about the long term stability and sustainability of our science and innovation ecosystem, supercharging private sector R&D investment from UK industry, charities and overseas investors alike.* (Paragraph 37)

Capital, resource and the ring-fence

2. While we welcome the Science and Innovation Strategy's commitment to delivering sufficient resource funding [for science infrastructure], and the Minister's assurance that this would be delivered, in reality, given existing capital commitments, this will only materialise with an upward trajectory in the resource budget. In addition, we are deeply concerned to hear of under-utilised facilities and a crisis in funding for mid-size equipment and core infrastructure. *We recommend that the Government conduct an urgent review of all existing capital allocations to ensure sufficient resource is in place to fully 'sweat our assets' and further recommend development of a more robust system of integrating future capital and resource allocations so that full value is realised for every capital investment.* (Paragraph 42)

3. *The Spending Review is being conducted under present protocols, dealing with capital and resource budgets for science separately. Any subsequent change to the way in which science and innovation spending are classified must be transparent, allowing like-for-like comparisons with year-on-year expenditures set in the Spending Review. The Government should make it clear in the Spending Review that ESA-10 will not be used as a means to change the underlying funding settlement.* (Paragraph 46)

4. The catapult network is a key success of the last Government's commitment to strengthen our capacity to exploit research by building better research-industry partnerships. It is understandable, therefore, that the current Government should wish to build on this success by expanding the catapult network. *While we commend the motivation, we feel the first priority should be to consolidate and establish the existing catapults — in particular ensuring that all catapults have the necessary operating resource and business strategies in order to operate at peak capacity.* (Paragraph 55)

5. *Catapults are only one strand of innovation support, however, and commitments to expanding the catapult network should not come at the expense of other innovation priorities. The Government has made successive, clear commitments to innovation more generally and should deliver on these by ring-fencing Innovate UK's budget.* (Paragraph 56)

6. *We recommend that major government policy announcements and new legislation should be routinely accompanied by a formal statement of the relevant evidence base, without depending on a prompt from our forthcoming evidence checks.* (Paragraph 58)

7. We are dismayed by the steep decline in research and development in some departments. This is driven by understandable budgetary pressures but also by lack of transparency surrounding these budgets. *We recommend that the Government produces an annual report to Parliament setting out, and explaining, public spending on science and innovation, including the rationale for the relative support given to scientific research and to innovation.* (Paragraph 60)

Distribution

8. The 'dual support' system has produced a world class and highly efficient system for scientific research. *Any significant changes to this system, including the balance of funding between research councils and university funding councils, would require a clear justification, which has yet to emerge. The Government should make clear its continued commitment to the dual support system and the previous Government's 2010 iteration of the Haldane Principle in the forthcoming Spending Review. A significant element of research funding should continue to be channelled though both the research councils and the higher education funding authorities.* (Paragraph 64)

9. Given the stable nature of funding allocations between the various research councils and the drive for greater strategic oversight in science funding, it is in order to consider if the research councils are working as an optimal system. However, the shift towards applied research over the last decade and the efficient, competitive and innovative output of the science they fund, imply that research councils are continuing to reflect changing research priorities and driving excellence in our science base. (Paragraph 68)

10. While most witnesses accept there is scope for better interdisciplinary working and strategic oversight between research councils, clear justification will be needed for any significant change in funding allocations, beyond simply seeking further administrative efficiency savings or structural adjustments. Sir Paul Nurse's review will guide this process, and the Government will no doubt weigh its conclusions carefully. *But we caution against a radical reorganisation of the research councils which could potentially harm the research programme. (*Paragraph 69)

Research and industry

11. We are disappointed that the Government has yet to respond to the Dowling Report given its important insights into gaps in our innovation landscape. *We recommend that the Government presents its response in the Spending Review.* (Paragraph 74)

12. Innovation loans may have a role to play as a new, additional, funding mechanism for later-stage ventures, but their success will depend greatly on the terms of any loans system introduced. *We recommend that the Government retains the current system of innovation grants as a key policy tool, alongside R&D tax credits, for de-risking innovation investment.* (Paragraph 77)

13. Tax incentives have become a significant and welcome support for businesses seeking funding to innovate by applying research, but there remains scope for further assistance. Given the often thin operating margins of risky innovative start–ups, the delay in waiting for R&D tax credits is not ideal. *We recommend that the Treasury critically examine in the Spending Review the potential for extending the scope and availability of tax incentives and investment vehicles for innovation businesses. It should also examine alternative models for R&D tax credit payment, including the scope for a quarterly schedule.* (Paragraph 80)

Formal Minutes

Tuesday 3 November 2015

Members present:

Nicola Blackwood, in the Chair

Chris Green	Graham Stringer
Dr Tania Mathias	Derek Thomas
Carol Monaghan	Matt Warman

Draft Report (*The science budget*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 80 read and agreed to.

Summary agreed to.

Resolved, That the Report be the First Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

[Adjourned till Tuesday 10 November at 2.00 pm

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the Committee's inquiry page at www.parliament.uk/science.

Wednesday 15 July 2015	*Question number*
Joseph Johnson MP, Minister of State for Universities and Science, **Gareth Davies**, Director General, Knowledge and Innovation, and **Philippa Lloyd**, Director General, People and Strategy, Department for Business, Innovation and Skills	Q1–47
Sir Paul Nurse, President, The Royal Society, **Professor Richard Parker CBE FREng**, Chair, Research and Secondments Committee, Royal Academy of Engineering, **Lord Stern of Brentford**, President, British Academy, and **Professor Sir John Tooke**, President, Academy of Medical Sciences	Q48–69
Tuesday 8 September 2015	
Dr Ruth McKernan CBE, Chief Executive, Innovate UK, and **Martyn Sené**, Deputy Director and Operations Director, National Physical Laboratory	Q70–105
David Sweeney, Director (Research, Education and Knowledge Exchange), Higher Education Funding Council for England, **Professor Rick Rylance**, Executive Group Chair, Research Councils UK, and **Professor Philip Nelson**, Executive Group Chair-elect, Research Councils UK	Q106–140
Tuesday 15 September 2015	
Professor Graeme Reid, Chair, Science and Research Policy, University College London, **Naomi Weir**, Acting Director, Campaign for Science and Engineering, and **Nicola Dandridge**, Chief Executive, Universities UK	Q141–174
Professor Sir Mark Walport, Government Chief Scientific Adviser, Government Office for Science	Q175–205
Professor Brian Cox, Physicist	Q206–223
Tuesday 13 October 2015	
Joseph Johnson MP, Minister of State for Universities and Science, and **Gareth Davies**, Director General, Knowledge and Innovation, Department for Business, Innovation and Skills	Q224–286
Bernard Ross, Chief Executive Officer, Sky Medical Technology Limited, **James Bromley**, Chief Operations Officer, SwiftKey, and **Dr Paul Beasley**, Head of Research and Development UK, Siemens	Q287–335

Published written evidence

The following written evidence was received and can be viewed on the Committee's inquiry web page at www.parliament.uk/science. TSB numbers are generated by the evidence processing system and so may not be complete.

1 ABPI (TSB0058)

2 Academy of Medical Sciences (TSB0076)

3 Academy of Social Sciences (TSB0036)

4 ADS (TSB0026)

5 Alzheimer's Research UK (TSB0069)

6 Arthritis Research UK (TSB0031)

7 Association of Medical Research Charities (TSB0041)

8 Association of Research Managers and Administrators (TSB0021)

9 Babraham Institute (TSB0002)

10 BioIndustry Association (BIA) (TSB0060)

11 British Academy (TSB0052)

12 British Council (TSB0038)

13 British Heart Foundation (TSB0015)

14 British Psychological Society (TSB0067)

15 British Society for Immunology (TSB0010)

16 Business, Innovation and Skills (TSB0075)

17 Campaign for Science and Engineering (TSB0051)

18 Cancer Research UK (TSB0005)

19 Celgene Ltd (TSB0040)

20 Centre for Process Innovation Limited (TSB0020)

21 Corewire Ltd (TSB0057)

22 Department for Business Innovation & Skills and the Department for Education (TSB0087)

23 Design Council (TSB0056)

24 Dr Peter Hedges (TSB0053)

25 EEF (TSB0074)

26 Element Six Ltd, Global Innovation Centre (TSB0003)

27 Energy Strategy Fellowship (TSB0073)

28 Engineering Professors' Council (TSB0009)

29 Engineering the Future (TSB0066)

30 Food Standards Agency (TSB0022)

31 Gen3 Systems Limited (TSB0044)

32 Genome Analysis Centre (TSB0071)

33 GSK (TSB0054)

34 Higher Education Funding Council for England (TSB0065)
35 Imperial College London (TSB0013)
36 Innovate UK (TSB0048), (TSB0085)
37 Institution of Environmental Sciences (TSB0072)
38 Institute of Food Research (TSB0043)
39 Institute of Physics (TSB0070)
40 Institution of Engineering and Technology (TSB0019)
41 John Innes Centre (TSB0001)
42 Met Office (TSB0083)
43 million+ (TSB0032)
44 Miss Tessa Burrington (TSB0080)
45 NatCen Social Research (TSB0039)
46 National Centre for Universities and Business (TSB0059)
47 National Institutes of Bioscience (TSB0027)
48 National Nuclear Laboratory (TSB0049)
49 National Physical Laboratory (TSB0030)
50 NDE Research Association (TSB0025)
51 Northern Health Science Alliance (TSB0014)
52 Parkinson's UK (TSB0018)
53 Political Studies Association of the UK (TSB0023)
54 Precision Acoustics Ltd (TSB0008)
55 Prof Toby Bruce (TSB0034)
56 Professor Alison Davenport (TSB0042)
57 Renewableuk (TSB0037)
58 Rolls-Royce (TSB0077)
59 Royal Academy of Engineering (TSB0079)
60 Royal Astronomical Society (TSB0050)
61 Royal Botanic Gardens, Kew (TSB0086)
62 Royal Society (TSB0063)
63 Royal Society of Edinburgh (TSB0061)
64 Royal Society of Biology (TSB0084)
65 Royal Society of Chemistry (TSB0035)
66 Russell Group (TSB0078)
67 Science Museum Group (TSB0033)
68 Scienceogram (TSB0028)
69 Scientists for Global Responsibility (TSB0016)
70 Scientists for Labour (TSB0012)
71 UK Computing Research Committee (TSB0017)

72 Universities UK (TSB0045), (TSB0082)

73 University Alliance (TSB0055)

74 University of Oxford (TSB0068)

75 University of Leeds (TSB0046)

76 Worshipful Company of Scientific Instrument Makers (TSB0081)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the Committee's website at www.parliament.uk/science.

The reference number of the Government's response to each Report is printed in brackets after the HC printing number.

Session 2015–16

First Special Report	Royal Botanic Gardens, Kew: Government Response to the Committee's Seventh Report of Session 2014–15	HC 454
Second Special Report	Current and future uses of biometric data and technologies: Government Response to the Committee's Sixth Report of Session 2014–15	HC 455
Third Special Report	Advanced genetic techniques for crop improvement: regulation, risk and precaution: Government Response to the Committee's Fifth Report of Session 2014–15	HC 519

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